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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/808,472	03/14/2001	David M. Pepper	B-3807 617493-8	3552

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EXAMINER

GLASS, CHRISTOPHER W

ART UNIT	PAPER NUMBER
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2878

DATE MAILED: 07/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/808,472

Applicant(s)

PEPPER ET AL.

Examiner

Christopher W. Glass

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☒ Claim(s) 8-10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

The sentence contained in lines 14-16 of page 2 is unclear due to the awkward syntax.

On line 24 of page 2, "in this case" is redundant and unnecessary.

On page 3, line 6, a first sentence should end at "(see Figure 3)" and a new sentence begin with "therefore".

"The a" appears on line 26 of page 5; one of these articles should be removed.

It appears within the context of the sentence that "as such" on line 30 of page 5 should read "such as".

On line 30 of page 6, "which" should be inserted after "quarter-wave plate 42".

On line 21 of page 8, "combiner" should be replaced by "combined".

Appropriate correction is required.

Claim Objections

2. Claim 8 is objected to because of the following informalities: on line 3, "sand seconds" should read "and second". Appropriate correction is required.

3. Claims 9 and 10 recite the limitation "said sonic vibrations" in line 1. There is insufficient antecedent basis for this limitation in the claims. Also, claim 12 recites the limitation "said adaptive beam combiner". There is insufficient antecedent basis for this limitation in the claim, and it appear that "combiner" should be replaced by "splitter".

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear as to whether the “beam director” and “beam splitter” are the same component; if these terms represent two separate elements, it is unclear as to how the laser beam propagates in relation to them.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1,3-7, and 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,909,279 to Pepper et al. (Pepper).

Regarding claims 1 and 3: Figure 1 of Pepper shows an optical apparatus for coherent detection of an input optical beam from source **10**, comprising a beam splitter **20** for splitting the input optical beam into a first component **24** and a second component **26** (see Column 5, lines 28-33), the optical beam having information content with a minimum signal frequency component, and an optical delay device **18** arranged to receive the second component, the optical delay device imposing an intentional delay, greater than an inverse of the minimum signal frequency component, in the second component of the input optical beam. Also disclosed is an adaptive beam combiner **22** coupled to receive the second component with a delay imposed thereon by the optical delay device and the first component from the beam splitter, the adaptive

beam combiner having two exiting optical components: a first optical component being representative of the difference of the first and second components received thereby, and a second exiting optical component being representative of the sum of the first and second components received thereby (see Column 5, lines 35-39). A detector arrangement **68** is also shown, for receiving and detecting the first and second exiting components from the adaptive beam combiner (see Column 3, lines 50-54).

Regarding claim 4: The optical delay device **18** of the optical apparatus of Pepper is a length of optic fiber (see Column 5, lines 25-46).

Regarding claim 5: The input optical beam of the optical apparatus of Pepper is generated by a transmitter of an optical communications system (see Column 4, lines 62-65 and Column 3, lines 34-45).

Regarding claims 6 and 11: Pepper discloses in Figure 1 a means for detecting sonic vibrations in a test material **38** having a test surface, comprising a means **10** for generating a beam of light having a wavelength, a beam splitter **20** for splitting the beam into a first and second beam **24** and **26**, respectively, a directing means **36** for directing the first beam onto the test surface to be scattered by the test surface with data having a minimum signal frequency component, means **18** for delaying the second beam by a period of time which is greater than an inverse of the minimum signal frequency component, means **52** for directing at least a portion of the scattered first beam and the delayed second beam on an adaptive beam splitter, and means **53,54,56,60,62** for directing the first and second beams onto photodetectors **68** to result in an electrical output signal that is representative of the vibrating test surface of test material **38**.

Regarding claim 7: the generated beam of light is a polarized coherent light beam and the first and second beams are co-propagating and co-polarized when impinging on the adaptive beam splitter (see Column 5, lines 13-33).

Regarding claims 9 and 10: The sonic vibrations of Pepper, detected in the test material having the test surface, are small vibrational surface deflections (see Column 9, lines 18-35) on the order of ultrasonic surface vibrations (see Column 4, lines 49-52).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,894,531 to Alcoz.

Regarding claim 1: Figure 1 of Alcoz shows an optical apparatus for coherent detection of an input optical beam from a source 1, comprising a beam splitter 4 for splitting the input optical beam into a first component and a second component, the optical beam having information content with a minimum signal frequency component, and an optical delay device 5 arranged to receive the second component, the optical delay device 5 imposing an intentional delay in the second component of the input optical beam. Also disclosed is an adaptive beam combiner 6 coupled to receive the second component with a delay imposed thereon by the optical delay device and the first component from the beam splitter. A detector arrangement 13,14 is also shown, for receiving and detecting one of these exiting components from the

adaptive beam combiner 6, after the radiation has been directed to and reflected from the surface 10 to be inspected; the other exiting component from the combiner 6 terminates at a light dump 8. The Figure 2 embodiment of Alcoz comprises an optical delay path having two mirrors 5 and 6, rather than an optical fiber delay, and shows two quarter-wavelength plates 2,7 disposed in the optical path. Beam splitter 3 separates an incident beam from laser 1 into first and second components, which are combined by combiner 4 (after propagating through first and second paths), in order to produce an optical delay between the two components, as well as to direct to and reflect radiation from an ultrasonic vibrating surface 9, for detection purposes (as by detectors 12,13). The device shown by Figure 1 of Alcoz does not expressly disclose the two exiting optical components from the beam combiner (see Column 5, line 55-Column 6, line 16) as having a first exiting optical component being representative of the difference of the first and second components received thereby, and a second exiting optical component being representative of the sum of the first and second components received thereby. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to configure these components in such a manner. A difference circuit or comparative element could have been provided in place of the light dump 8, and a summing circuit which would join the first and second exiting components from the beam splitter 6 could have been implemented, in order to produce a differential interference signal or a signal having two transposed and differing phases, respectively.

Regarding claim 2, insofar as understood: The modified optical apparatus of Alcoz in Figure 2 shows an optical apparatus providing an input optical beam from a probe laser 1 to a workpiece under test 9 which is subjected to an ultrasonic excitation pulse (see Column 4, lines

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30-32), as well as beam directors for receiving a laser beam from the probe laser 1 and directing resulting first and second components of the laser beam to and from the workpiece 9 and through a delay path comprising mirrors 5 and 6. Also shown by Alcoz is a quarter wave plate 2 disposed in the path of the first component of the laser beam, wherein the first component of the laser beam corresponds to the first component of the optical beam and wherein the second component of the laser beam corresponds to the second component of the optical beam.

Regarding claim 3: Alcoz does not specifically teach the delay imposed by the optical delay device 5 (fiber) as being greater than an inverse of the minimum signal frequency component. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have varied the length of the fiber to obtain this ideal configuration, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 4: The optical delay device 5 shown in Figure 1 of the modified device of Alcoz is a length of optic fiber.

Regarding claim 5: While the optical apparatus of Alcoz does not specifically teach the transmitter (laser 1) which produces the input optical beam as being implemented in an optical communications system, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used this component in such a system. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 6 and 11: Alcoz discloses in Figure 2 a means for detecting sonic vibrations in a test material having a test surface 9, comprising a means 1 for generating a beam of light having a wavelength, a means 3 for splitting the beam into a first beam and second beam, and a means for directing the first beam onto the test surface 9 to be scattered by the test surface with data having a minimum signal frequency component. Also shown is a means (comprising mirrors 5 and 6) for delaying the second beam for a period of time, a directing means for directing at least a portion of the scattered first beam and the delayed second beam on an adaptive beam splitter 4, and means for directing the first and second beams onto photodetectors 12,13 to result in an electrical output signal that is representative of the vibrating test surface 9. The adaptive beam splitter 4 is shown as having a receiving surface for receiving at least a portion of the scattered first light beam at a first angle relative to the receiving surface, and for receiving the second light beam at a second angle relative to the receiving surface which is different from the first angle, for interfering the first and second beams to introduce a phase shift difference between the first and second beams, and for producing co-propagating light waves comprising at least a portion of the first beam and at least a portion of the second beam received by the receiving surface. Alcoz does not specifically teach the delay imposed by the optical delay device 5,6 as being greater than an inverse of the minimum signal frequency component. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have varied the spacing of the mirrors 5,6, and therefore the length of the optical delay path, to obtain this ideal configuration, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 7: The light from “a linearly polarized laser 1” in the modified means of Alcoz “is converted to circular polarization by a quarter-waveplate 2...A 50/50 non-polarizing beam-splitter 3 splits the light into two equal-power beams, the clockwise (c.w.) beam traveling towards the mirror 5 and the counterclockwise (c.c.w.) beam traveling towards the polarizing beam splitter 4. The c.w. beam is reflected by mirrors 5 and 6, which serve as an optical delay, and reaches the polarizing beam splitter 4” (Column 4, lines 15-25). Therefore, the generated beam of light is a polarized coherent light beam, wherein the first and second beams are co-propagating and co-polarized when impinging on the adaptive beam splitter 4.

Regarding claims 8 and 12: The modified means of Alcoz does not specifically teach the first and second beams as not being co-propagating and co-polarized immediately after the second beam is delayed by the delaying step having mirrors 5,6. Also, it does not teach these beams as being independently subjected to a polarization correcting step to ensure that the two beams have the same polarization before impinging on the adaptive beam splitter 4. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have provided the quarter-wavelength plate 2 in or after the delay path, for the second optical beam, and to have disposed another quarter-wavelength plate (e.g. plate 7 shown in Figure 2), downstream of the first split, in the path of the first beam, such that each of the beam paths could have identical polarization.

Regarding claims 9 and 10: The test surface 9 of the modified means of Alcoz is an “ultrasonically vibrating surface” (Column 4, line 32).

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Alcoz, in view of U.S. Patent No. 6,057,911 to Reich. The modified means of Alcoz shows a polarization beam

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splitter 4, but does not specifically teach including a 90° beam rotator arranged in series in paths associated with the first and second light beams. However, it is well known in the art to implement 90° beam rotator components in such a system. Figure 2 of Reich shows an optical apparatus comprising a source 106 producing a beam which is split into two separate components 110,112 by a beam splitter 108, before being recombined by an adaptive beam splitter 118. "The second beam 112 is directed through a ½ wave plate 116 which delays the beam so as to place it in quadrature with the first beam 110 and also rotates the polarization of the beam by 90 degrees" (Column 5, lines 36-39). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have implemented such a wave plate in the correction path for each of the two separate beam components of Alcoz, in order to independently correct the polarization and rotate each of the beams by 90 degrees.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 4,572,949 to Bowers et al. discloses a fiber optic sensor for detecting very small displacements of a surface. Figure 6 shows a configuration having a laser source 10 producing a beam to be separated by a beam splitter 22 into two components: a first delay path 14 implementing a delay fiber 62, and a second path 20. These beam components are then recombined by an adaptive beam splitter/combiner 24, to radiate a sample 16 to be tested. A detector apparatus 28 is also shown for detecting a signal reflected from the vibrating surface 18 of the sample 16.

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U.S. Patent No. 5,080,491 to Monchalin et al. discloses a laser optical ultrasound detection apparatus which uses two interferometer systems. Figure 4 shows a configuration which comprises a laser, beam splitters **PBS,41,61**, interferometers **43,45**, and detectors **57,59**.

U.S. Patent No. 6,075,603 to O'Meara et al. discloses a contactless acoustic sensing system having detector array scanning and self-calibration, and shows in Figure 1 a configuration comprising a laser **8** radiating a workpiece **2** to be tested, a beam splitter **20**, a quarter-wavelength plate **16**, and detectors **64**.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher W. Glass whose telephone number is 703-305-1980. The examiner can normally be reached 9:00am-6:00pm, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached at 703-308-4881. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

CG
June 28, 2002


STEPHONE ALLEN
PRIMARY EXAMINER